Novel docetaxel chitosan-coated PLGA/PCL nanoparticles with magnified cytotoxicity and bioavailability

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Abstract

In the present study, docetaxel (DTX)-loaded poly(lactic-co-glycolic acid) (PLGA) and polycaprolactone (PCL) nanoparticles were successfully prepared and coated with chitosan (CS). The prepared nanoparticles (NPs) were evaluated for their particle size, zeta potential, particle morphology, drug entrapment efficiency (EE%), and in vitro drug release profile. The anticancer activity of DTX-loaded NPs was assessed in human HT29 colon cancer cell line utilizing MTT assay. The pharmacokinetics of DTX-loaded NPs was monitored in Wistar rats in comparison to DTX solution. The prepared NPs exhibited particle sizes in the range 177.1 +/- 8.2-287.6 +/- 14.3 nm. CS decorated NPs exhibited a significant increase in particle size and a switch of zeta potential from negative to positive. In addition, high EE% values were obtained for CS coated PCL NPs and PLGA NPs as 67.1 and 76.2%, respectively. Moreover, lowering the rate of DTX in vitro release was achieved within 48 h by using CS coated NPs. Furthermore, a tremendous increase in DTX cytotoxicity was observed by CS-decorated PLGA NPs compared to all other NPs including DTX-free-NPs and pure DTX. The in vivo study revealed significant enhancement in DTX bioavailability from CS-decorated PLGA NPs with more than 4-fold increase in AUC compared to DTX solution. In conclusion, CS-decorated PLGA NPs are a considerable DTX-delivery carrier with magnificent antitumor efficacy.

Keywords

Author Keywords: Docetaxel; PLGA; PCL; Chitosan; Nanoparticles; Cytotoxicity; Pharmacokinetics
KeyWords Plus: GLYCOLIC ACID PLGA; IN-VITRO RELEASE; DRUG-DELIVERY; LOADED PLGA; SURFACE MODIFICATION; VIVO; MICROSPHERES; FORMULATION; CANCER; POLY(D,L-LACTIDE-CO-GLYCOLIDE)

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1. **Low density lipoprotein modified silica nanoparticles loaded with docetaxel and thalidomide for effective chemotherapy of liver cancer** **Times Cited: 1**

   By: Ao, Man; Xiao, Xu; Ao, Yazhou

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2. **Di-Block PLCL and Tri-Block PLCLG Matrix Polymeric Nanoparticles Enhanced the Anticancer Activity of** **Times Cited: 1**